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SOME SOCIAL APPLICATIONS OF THE DOCTRINE OF PROBABILITY.¹

I.

THE CLASSIFICATION OF HUMAN CHARACTERISTICS.

WITH the increasing complexity of the life of civilized man, with the more minute division of labor and the greater differentiation of individuals, the mental traits of men become extraordinarily diversified. This statement will doubtless be readily accepted by all. Its truth is shown by our ordinary habit of speech. What fine distinctions we make, for example, between curiosity, inquisitiveness, thirst for knowledge, and the instinct of investigation. Or again, what subtle discriminations we make between industry, patience, assiduity, activity, endurance, perseverance, application, and complete devotion. Speech is, indeed, too poor to designate all the shades of meaning which intervene in such a series of synonyms, and we are often in doubt whether we shall call a certain characteristic by one or another name. The mere catalogue of the terms that we use to designate the mental traits of men would fill many pages, and the exact definition of each and all of them would be no light task. The traits themselves are yet more numerous and many-sided.

It is important to realize that these traits differ not only qualitatively, but quantitatively. We have, indeed, no scale or standard for measuring the mental powers so exactly as the bodily forces are measured by the dynamometer. Yet we are fully convinced that great quantitative differences prevail—for example in point of intelligence. Thus we speak of genius, of talent, of ability, of mediocrity, of inefficiency,

¹ Translated with additions and notes by Carlos C. Closson.

[These pages are from OTTO AMMON'S *Die Gesellschaftsordnung und ihre natürlichen Grundlagen* (second edition, Jena 1896), an English translation of which is now in preparation. Ammon's work is a utilization in political, social and economic problems of the doctrine of heredity, natural selection, the relative frequency of different grades of human ability, social stratification, and social capillarity. The effort is made to bring the separate results of researches in biology, anthropology, economics, and statistics into a unified treatise which, without sacrificing thoroughness, shall be readily intelligible to the reader without technical training in these fields of investigation.—TRANSLATOR'S NOTE.]

of weak intellect, of stupidity, and of imbecility. So, again, we recognize a similar gradation in point of industry, power of application, concentration, etc.—from the extraordinary absorption of an Edison to the inability for any serious work characteristic of tramps and vagrants, there exists a multitude of gradations.

The great number of differentiated traits and the multitude of grades in which any trait may occur, obviously allow of an almost infinite number of combinations. Hence is to be explained the variety of human individuals, and the fact that among all the millions of men there are never to be found two completely similar in mind and character. It is to be remembered that in consequence of the laws of heredity, and particularly of amphimixis, new combinations appear in the different children of the same parents, as well as in children of different families, and that there is thus offered an almost inexhaustible choice of types as the raw material for natural selection. To explain this in very general terms: the son of an intelligent but lazy father, for example, and of a mother of poor intelligence but of perseverance and will power, may combine in himself the better qualities of both parents; another son of the same parents may inherit the weakness of both without their distinctive merits; so also in the other children the parental traits may appear in various combinations—the traits of the different children thus varying qualitatively and quantitatively.

The doctrine of combinations, or the doctrine of probability,—a branch of pure mathematics—explains the law which prevails, amidst apparent chaos, in the greater or less frequency of the appearance of the particular combinations of the intellectual traits.

In order to understand this most easily, we must concentrate our attention. We must not introduce at first the great number of separate elements, but must classify these under certain groups and grades; the simple results that we shall thus reach can then be extended to cover the more complicated conditions that exist in reality. For reasons that will be presently understood, we take, in the first place, three groups of mental traits which are largely decisive of the place which a man will occupy in life.

1. Intellectual traits; among which I include all that belong to the rational side of man—power of quick comprehension, memory, power of judgment, power of invention, and whatever else belongs in this field.

2. Moral traits; namely, self control, will power, industry, persever-

ance, moderation, reliability, regard for family obligations (*Familien-sinn*), honesty, and the like.

3. Economic traits; such as business ability, organizing talent, technical skill, caution, clever calculation, foresight, thrift, and so forth.

In criticism of this division, it has been urged¹ that the economic traits should not constitute a separate group but are only combinations of mental and moral characteristics. Of this, however, I am not wholly convinced, and therefore I retain for the time being the above division, which has the advantage of completeness.

The altruistic traits; such as love of one's neighbor, unselfishness, helpfulness, readiness for self-sacrifice, etc., form a special branch of the moral traits. They are to be left out of view for the present, because their effect on the success of the individual is open to question. In so far as an altruistic disposition engenders for its possessor the respect and regard that are essential for the successful occupancy of the highest positions, an altruistic character may well be advantageous to the individual. In the middle or lower positions of life, however, a high degree of altruism is usually rather a hinderance than a help to the person possessing it. For the sake of simplicity, therefore, we exclude this group of traits for the present, to return to it later.

To the above three groups of mental traits must be added a fourth group devoted to physical characteristics. Health and strength alone cannot accomplish much in modern life, but they are indispensable for the full utilization of mental gifts.

4. Bodily traits: power to work, endurance, power of undergoing exertions and of resisting excitements of every kind, vigor, good health, etc.

Thus far we have drawn qualitative distinctions. Now as concerns the quantitative relations of these particular groups, we may designate the highest grade that may be attained in each group by the figure 6, the lowest grade by the figure 1, and the intermediate grades by the figures 5, 4, 3, and 2. We have, then, in the case of each of the four groups of traits six different grades, and we will now see what combinations can be formed therewith, and which of these combinations will appear the most frequently.

¹[For example by Dr. JULIUS WOLF in *Jahrbücher für Nationalökonomie und Statistik*, vol. x (July 1895).—TRANSLATOR'S NOTE.]

II.

A FEW ELEMENTS OF THE DOCTRINE OF COMBINATIONS.

Aside from Darwinism, nothing is perhaps more uncongenial to the products of our philological and "juristic" education, than a mathematical formula. As this book is intended for the use of any person of general education, and as I could not conscientiously omit the theory of natural selection, I will at least abstain from mathematical formulæ while I clothe in as attractive a picture as possible the necessary elements of the doctrine of combinations.

Let not the reader be offended if we start with a very humble parable, and one indeed which may seem to have a slight tinge of sinister connotation. Let us take four dice, the six faces of each die being marked with spots from 1 up to 6. Let the first die represent the mental traits, and its six surfaces stand, according to their spots, for the six grades 1 to 6 in which we have supposed these traits to occur. The surfaces of the second die signify likewise the moral traits in their different grades of strength; the other two dice stand similarly for the economic and the bodily traits necessary to the success of the individual. We can now, by throwing the dice, get some hints as to the relative frequency of the possible combinations of the different traits in their different grades.

In general there are with four dice ($6 \times 6 \times 6 \times 6$) 1296 different throws possible. That is, each die can show any one of its six sides while the three remaining dice remain unchanged.

The highest possible throw is that in which the sum of the spots is equal to 24, and this can occur only in a single way, namely, that every die shows six spots. In our parable this suggests that among 1296 individuals will be found only a single one in whom the mental, moral, economic, and bodily traits all attain the highest grade.

If descending a little in the scale of perfection, we assume that one of the four groups of traits attains only the next inferior grade, the grade, namely, expressed by 5, we have four possible combinations, or, in other words, four individuals, represented by the throws 6, 6, 6, 5,—6, 6, 5, 6—6, 5, 6, 6—and 5, 6, 6, 6. Such men whose capacities are represented by the sum of 23 spots, are then four times as numerous as the number-one-men who correspond to the sum of 24 spots.

The next rank is that which is expressed by the sum of 22 spots. This sum can occur through two kinds of combinations; it occurs

either when two groups of traits are expressed by 6 and two others by 5, or when three groups are expressed by 6 and the remaining one by 4. We have then the possibilities 6, 6, 5, 5—6, 5, 5, 6—6, 5, 6, 5—5, 5, 6, 6—5, 6, 6, 5—5, 6, 5, 6—making 6 throws, and in addition, 6, 6, 6, 4—6, 6, 4, 6—6, 4, 6, 6—4, 6, 6, 6—these last four making in all 10 throws, each of which gives the sum of 22 spots.

The sum of 21 is attainable through four kinds of combinations by 20 different throws: the sum of 20 is attainable through five kinds of combinations by 35 throws; and so on, with every decrease in the sum of the spots, the kinds of combinations and the number of possible throws increases. This holds as far as the average or middle sum of 14 spots which can be attained in 12 different ways with 146 different throws. Then the frequency decreases exactly in the inverse order that it has been increasing, so that, for example, the sum of 6 spots is attainable by any one of 10 throws, the sum of 5, by 4 throws, and the least sum, that of 4 spots, by only one throw.¹ This last throw show-

¹ It is hardly necessary to give in detail the possible throws through which each sum may be attained. By way of example, it may be shown here how the sum of 14 spots is attainable through 12 different kinds of combinations in 146 different throws:

1.	Combination	4 4 4 2	4 4 2 4	4 2 4 4	2 4 4 4	= 4 throws
2.	"	4 4 3 3	4 3 4 3	4 3 3 4	3 4 3 4	3 4 4 3	3 3 4 4	" 6 "
3.	"	{ 4 4 5 1	4 4 1 5	4 5 4 1	4 5 1 4	5 1 5 4	4 1 4 5 }	" 12 "
		{ 5 1 4 4	5 4 4 1	5 4 1 4	1 5 4 4	1 4 4 5	1 4 5 4 }	
4.	"	{ 4 5 3 2	4 5 2 3	4 3 5 2	4 3 2 5	4 2 5 3	4 2 3 5 }	" 24 "
		{ 5 4 3 2	5 4 2 3	5 3 4 2	5 3 2 4	5 2 4 3	5 2 3 4 }	
		{ 3 2 4 5	3 2 5 4	3 4 5 2	3 4 2 5	3 5 4 2	3 5 2 4 }	
		{ 2 3 4 5	2 3 5 4	2 4 3 5	2 4 5 3	2 5 4 3	2 5 3 4 }	
5.	"	{ 5 5 3 1	5 5 1 3	5 3 5 1	5 3 1 5	5 1 5 3	5 1 3 5 }	" 12 "
		{ 3 1 5 5	3 5 5 1	3 5 1 5	1 3 5 5	1 5 5 3	1 5 3 5 }	
6.	"	5 5 2 2	5 2 5 2	5 2 2 5	2 5 2 5	2 5 5 2	2 2 5 5	" 6 "
7.	"	5 3 3 3	3 5 3 3	3 3 5 3	3 3 3 5	" 4 "
8.	"	{ 6 2 3 3	6 3 3 2	6 3 2 3	2 6 3 3	2 3 6 3	2 3 3 6 }	" 12 "
		{ 3 3 6 2	3 3 2 6	3 6 3 2	3 6 2 3	3 2 6 3	3 2 3 6 }	
9.	"	{ 6 4 3 1	6 4 1 3	6 3 4 1	6 3 1 4	6 1 4 3	6 1 3 4 }	" 24 "
		{ 4 6 3 1	4 6 1 3	4 3 6 1	4 3 1 6	4 1 6 3	4 1 3 6 }	
		{ 3 6 4 1	3 6 1 4	3 4 6 1	3 4 1 6	3 1 6 4	3 1 4 6 }	
		{ 1 6 4 3	1 6 3 4	1 4 6 3	1 4 3 6	1 3 6 4	1 3 4 6 }	
10.	"	{ 6 4 2 2	6 2 2 4	6 2 4 2	4 6 2 2	4 2 2 6	4 2 6 2 }	" 12 "
		{ 2 2 6 4	2 2 4 6	2 6 2 4	2 6 4 2	2 6 4 2	2 4 6 2 }	
11.	"	{ 6 5 2 1	6 5 1 2	6 2 5 1	6 2 1 5	6 1 5 2	6 1 2 5 }	" 24 "
		{ 5 6 2 1	5 6 1 2	2 6 5 1	2 6 1 5	1 6 5 2	1 6 2 5 }	
		{ 2 6 5 1	2 6 1 5	2 5 6 1	2 5 1 6	2 1 5 6	2 1 6 5 }	
		{ 1 6 5 2	1 6 2 5	1 5 6 2	1 5 2 6	1 2 5 6	1 2 6 5 }	
12.	"	6 6 1 1	6 1 6 1	6 1 1 6	1 6 1 6	1 6 6 1	1 1 6 6	" 6 "

ing 1 spot on each of the four dice, signifies in our comparison a man exceptionally poor in all four groups of traits, weak-winded and sickly.

The following table presents a summary of these results :

Among 1296 possible throws

The sum of 24 spots will appear once.

"	23	"	"	"	2 times.
"	22	"	"	"	10 "
"	21	"	"	"	20 "
"	20	"	"	"	35 "
"	19	"	"	"	56 "
"	18	"	"	"	80 "
"	17	"	"	"	104 "
"	16	"	"	"	125 "
"	15	"	"	"	140 "
"	14	"	"	"	146 "
"	13	"	"	"	140 "
"	12	"	"	"	125 "
"	11	"	"	"	104 "
"	10	"	"	"	80 "
"	9	"	"	"	56 "
"	8	"	"	"	35 "
"	7	"	"	"	20 "
"	6	"	"	"	10 "
"	5	"	"	"	4 "
"	4	"	"	"	once.

This table signifies : If we make with four dice 1296 throws, every one of the possible sums from 24 spots down to 4 will, theoretically, appear with the designated frequency ; for example, the sum 18, 80 times ; the sum 9, 56 times, etc. In reality, of course, these results will only *tend* to occur ; in any single trial chance variations will appear. But the more often the experiment is repeated, so much the more will these variations be neutralized ; and if we take the average from a great number of trials, the results will approximate more and more closely to the theoretical probability.

It will have impressed the reader already that the number of the extremely high throws, as also that of the extremely low ones, is comparatively small, while the average or nearly average throws appear very frequently. Directed toward our present subject this signifies that the number of men of genius and high talent is relatively small, because in accordance with mathematical laws the necessary combina-

tion of traits can appear but seldom. Correspondingly, the number of the weak-minded and of the imbecile is relatively small, while the number of those of about average ability is far in excess of that of the two extremes.

This analogy of the dice is useful, not only because it simplifies the general subject, but also because it suggests the explanation for the peculiar fact that so many otherwise good observers err in regard to what constitutes mediocrity and thus overrate the average capacity of the masses. Let us, for example, take as representative of mediocrity the sum of 14 spots. This sum can occur, as shown above, in not less than 146 different throws. Among these throws are such combinations as 4, 4, 3, 3—4, 3, 4, 3—4, 3, 3, 4—3, 4, 3, 4—3, 4, 4—3, 3, 4, 4—but there are also a very different class of combination, such as 6, 6, 1, 1—6, 1, 6, 1—6, 1, 1, 6—1, 6, 1, 6—1, 6, 6, 1—1, 1, 6, 6—which equally give the sum of 14. In our comparison the combinations of the first group stand for individuals of fair “all-round” abilities, capable in all respects of filling a modest but useful place; the other group, however, represents the persons of unbalanced, inharmonious gifts, who, in spite of some brilliant qualities, cannot successfully meet the tests of life. Sometimes, for example, these last possess high intelligence and moral traits but lack economic characteristics and physical stamina. So, again, they may possess the traits of any two of these four groups in the degree of excellence indicated by 6, but be handicapped by the weakness denoted by 1 in respect to the traits of the other two groups.

While the limitations of the first of the above classes—men of moderate but well-balanced endowments—are in general obvious, the members of the second class give under certain conditions the impression of men of great potential ability, who simply have not been able to get a start or to force themselves ahead. They are regarded as “men of unrecognized worth” or even as “suppressed geniuses.” Hence the responsibility for their failure is laid upon insufficient education, unfavorable circumstances, or, preferably, “the prevailing social organization,” whereas the real difficulty is in the weak sides of the individual’s own constitution.

Further, it is to be noted that in our example of the dice, down to the sum of 9 spots some *one* group of traits can be present in the highest grade denoted by 6, in which case the three others must be represented each by the figure 1. Two 5’s can appear down to the sum of 12 spots, and one 5 down to the sum of 8. But, as may be seen by

working out the calculation, the lower sums are usually composed of the figures denoting the average or lower grades, 4, 4, 4, 4—3, 3, 3, 3—2, 2, 2, 2—or of combinations of these figures, such as 4, 3, 2, 1. This means that out of the general mass of the moderately or somewhat poorly endowed there are to be distinguished a considerable number conspicuous for some *one* highly developed trait, which may, for example, be a keen “mother wit,” great steadfastness in adversity, or an excellent knowledge of business, according as the 6 spots have been thrown with the die standing for the intellectual, the moral, or the economic traits. Such persons give the impression that the organization of society has done them grievous wrong in assigning them so low a rank in life as they often occupy. To see the error involved in this judgment, it is necessary to consider their personalities as a whole. If, for example, the 6 is thrown with the die representing the group of physical traits, we have a man who is a Hercules in bodily strength, but who, because of his slight mental endowment, is available only for exhibition at side shows and country fairs.

Now let us introduce, along with the above egoistic moral traits, the altruistic characteristics, which we have so far eliminated. We can easily understand that these unselfish traits may be strongly developed in many individuals who are otherwise of poor or only average endowments. From this combination there arises a strong inner pressure to relieve misery in the world, without, however, the presence of the right judgment or ability for such efforts. Hence it is that wholly visionary plans of social betterment find such ready favor, and that sometimes great philanthropic undertakings come to grief or are saved only by the control being turned over to persons more egoistic, perhaps, than the originators, but of greater practical ability. Similarly, it is easy to understand that the organizers of industry, indispensable as they are for social progress, are most often not as exceptionally endowed in altruistic traits as in other respects. Many “captains of industry” are, it is true, thus endowed, because in their class all grades of altruism are represented, but it can only happen through chance that the fittest should also be the most self-sacrificing. Moreover, many business men achieve success not so much through any talent for organization as through shrewdness and close economy. These latter, of course, cannot be depended on for altruistic efforts, and it is obvious that a public concern for the welfare of the laborers is necessary to supplement the efforts of the best-disposed employers and to bring their competitors

up to the same standard. Great statesmen must under all conditions possess a strong spirit of altruism. They can fulfill their duties only when they enter completely into the interests of their people.

In general it is the case that the higher we go the more harmonious is the endowment. The number one and the number two men have not only great abilities but a many sided well-balanced and complete mental equipment. But it is a law of nature that such men appear only sparingly, and society deserves no reproach if it bars the way for the "incapable worthy" and the "unrecognized genius;" for only personalities especially endowed in everyone of the principal groups of traits can be utilized in important posts with safety to the highest human interests.

III.

UTILIZATION AFTER GALTON OF THE DOCTRINE OF COMBINATIONS IN REFERENCE TO MENTAL TRAITS.

Up to this point we have regarded the throwing of the dice as simply a comparison or analogy; but in all probability it is much more than this, namely, an essentially true representation of the phenomena which actually occur before and in connection with fecundation. The separation of the determinants, that is of the groups of determinants,¹ in the reducing division,² and the union of the two parental germ plasms³, must almost certainly conform to the laws of combination. The determinants which represent in the germ plasm the different traits of the future individual, and which correspond, according to the number and organic connection of their molecules, to the strength that these traits will attain — these determinants will unite and form new combinations in the same way as the dice produce manifold combinations with their spots. If this is the case, our analogy becomes a reality.

We must now consider what modifications must be introduced before the results already reached can be fully applied to the subject of the frequency of different grades of ability among men.

We provisionally divided the mental traits favorable to the success of the individual into three groups and added thereto a fourth group of bodily traits. We later introduced the altruistic traits which are

¹ A. WEISMANN, *The Germ Plasm*, New York, 1893, p. 62.

² *Ibid.*, chap. viii.

³ *Ibid.*, chap. ix.

beneficial to society but not always advantageous to the individual himself. This classification was provisionally allowable for the sake of simplicity. In reality, however, it is evident that each of the above groups consists of traits or combinations of traits which are not necessarily associated together. One may, for example, possess a few intellectual, moral, or economic traits in much higher grade than other traits of the same group; again, full bodily vigor is the result of a great number of excellencies in different parts of the body. Instead of simply combining four elements, we should then, to conform to reality, have utilized a much greater number. In what ways would the results have thus been affected?

The greater we conceive the number of transmissible traits, the less frequently will the individuals appear in whom all or nearly all of these traits combine; the more rare, in other words, will be the individuals of genius and high talent. If, instead of four dice we take eight, we shall have a pre-eminent man no longer among 1296 individuals but among $6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 \times 6 = 1,679,616$ individuals. The very poorly endowed become correspondingly rare and the proportion of mediocrity becomes more overwhelming. Any increase in the number of grades in which each trait may occur — represented above by the number of spots on the dice — works in the same direction. Under our provisional assumption, the most brilliant man was only six times the superior of the most stupid. If we put the ability of the former as twelve times that of the latter; if, in other words, we choose instead of the cubes with six surfaces, dodecahedrons, the twelve planes of which are marked with from one to twelve spots, — the number of possible throws with four such dice is $12 \times 12 \times 12 \times 12 = 20,736$, and we have then a pre-eminent man among 20,736, instead of as before among 1296 individuals. With eight such twelve-sided dice the number of individuals among whom would occur one pre-eminent man would reach not less than 429,981,696.

A third factor operates in the same direction. There is an equal probability that a die will fall with any one of its sides uppermost. Our example has then implied that the several grades of any trait will appear with equal frequency. But in reality the high and the low grades of a mental trait, as the expression of the cells or molecules of the brain substance, occur more seldom than the middle grades. In other words, the strength of each particular trait follows the same law that governs the combination of the different traits. This circumstance

also lessens the number of exceptional personalities which are found in a certain number of individuals and increases the number of the mediocre.

The total result of the laws here prevailing may be embodied in a simple formula,¹ which expresses in general the frequency of variations from a mean, and which can be utilized for our purpose, provided the coefficients are determined empirically. The number of the individual traits can then be left out of consideration, which is much to be desired since their number cannot be determined; it is perhaps as great as the number of cells or even of molecules of which the brain is composed, since any one of these elements may vary independently. With the aid of this formula, it is also unnecessary to determine the number of the different grades of each trait and the frequency of these several grades.²

¹ The formula is $y = Ye^{-h^2x^2}$. Galton ascribed it to the Belgian astronomer and statistician, Quételet. The prior utilization of the formula, however, for the doctrine of combinations and the calculation of probabilities is to be credited to Gauss, and appeared in the "Theoria de Combinationis Observationum Erroribus Obnoxiae" published in the *Commentationes Societatis Regiae Scientiarum Gottingensis*, 1823.

[See also: A. QUÉTELET, *Lettres . . . sur la théorie des probabilités, appliquée aux sciences morales et politiques*, Bruxelles, 1846, English translation by Downes, London, 1849; F. GALTON, *Hereditary Genius*, London, 1869; *Natural Inheritance*, London, 1889; JOHN FISKE, "Sociology and Hero Worship," *Atlantic Monthly*, January 1881; O. AMMON, *Der Abänderungsspielraum: ein Beitrag zur Theorie der natürlichen Auslese*, Berlin, 1896; E. T. BREWSTER, "A Measure of Variability, and the Relation of Individual Variations to Specific Differences," *Contributions from the Zoological Laboratory . . . at Harvard College . . .* No. LXXIX, 1897; and the following, cited among others by Brewster: A. WEISBACH, *Körpermessungen verschiedener Menschenrassen*, Berlin, 1878. L. STIEDA, "Über die Anwendung der Wahrscheinlichkeitsrechnung in der anthropologischen Statistik," *Archiv für Anthropologie* Band xiv. pp. 167-182, 1882.—TRANSLATOR'S NOTE.]

² In the formula x signifies the degree of variation from the mean, y the relative frequency of the appearance of this variation (that is its "probability"), Y the frequency of the mean, e the basis of the hyperbolic logarithms, h the so-called coefficient of precision which determines whether the frequency of occurrence shall diminish more or less rapidly with the increasing degree of variation from the mean. The quantity e is a constant, fixed once and for all; Y and h are constants which may be altered according as the formula is differently utilized. It will be seen from this formula that the frequency of occurrence y must decrease very rapidly with the increase of x , the degree of variation from the mean. This will appear more clearly if the formula be written thus $y = \frac{Y}{e^{h^2x^2}}$. Any increase in x will obviously rapidly increase the denominator and lessen the value of y .—AMMON, *Der Abänderungsspielraum*, p. 5.

Francis Galton has empirically determined the coefficients in accordance with data drawn from English sources, and we borrow from him the figures which he has calculated for the division of a million men into each grade or degree of ability.

The division into sixteen classes, chosen by Galton, is an arbitrary one, for the transitions are really continuous and might be grouped into more or fewer classes.¹ But his practical insight led him to accept a division which gave a broadly correct view.²

The classes are designated by letters, the classes above the mean by capitals and those below by the corresponding small letters. Because of the symmetry of the formula the number of persons assigned to the class designated by each capital is the same as the number assigned to the corresponding small letter.

Class A and class a signify ability of about the average grade, respectively slightly above and slightly below the mean. Class B is a somewhat higher, and class b a somewhat lower degree of ability. These four taken together constitute the great mass of mediocrity. Classes C and D embrace already personalities of considerable and marked ability. Members of class E are talented in the ordinary

¹ "The number of grades into which we may divide ability is purely a matter of option. We may consult our convenience by sorting Englishmen into a few large classes, or into many small ones. I will select a system of classification which shall be easily comparable with the number of eminent men, as determined in the previous chapter. We have seen that 250 men per million become eminent; accordingly I have so contrived the classes in the table that the two highest, F and G, together with X (which includes all cases beyond G, and which are unclassified), shall amount to about that number—namely 248 per million."—GALTON, *Hereditary Genius*, chap. iii.

² [Galton's results are, it is true, based on an assumption which he does not, perhaps, fully justify, and which he very probably makes in a somewhat too unqualified sense. This assumption is that men of natural genius and high talent (combined with the necessary health, power of labor and perseverance) will in general reach fame or distinction, whatever may be the obstacles from lack of education and social advantages etc.; in other words, that the number of famous, eminent, and distinguished men is a correct measure of the number of men of natural genius, high talent, and ability. This assumption has been naturally much disputed. Professor William James has questioned whether "genius [of certain kinds] will out" quite so inevitably as Galton supposes (*Atlantic Monthly*, October 1886). D. G. Ritchie and (more elaborately) C. H. Cooley have advanced similar criticisms (*Darwinism and Politics*, Sec. 6 and *Annals of the American Academy of Political and Social Science*, May 1897. What Ammon says in this article in regard to inharmonious endowment helps to clear up some of the points in this controversy. I am gathering statistics which I hope will throw light on some of the other questions involved.—TRANSLATOR'S NOTE.]

sense; those of classes F and G are eminently and pre-eminently talented. Grade X, embracing everything above G, corresponds to true genius. In the other direction the classes c, d, e, f, g, and x descend through various degrees of stupidity to imbecility and complete idiocy.

The distribution of a million men among the various classes is according to Galton, the following :

Class X	-	-	-	-	1 individual
G	-	-	-	-	14 individuals
F	-	-	-	-	233 "
E	-	-	-	-	2,423 "
D	-	-	-	-	15,696 "
C	-	-	-	-	63,563 "
B	-	-	-	-	161,279 "
A	-	-	-	-	256,791 "
a	-	-	-	-	256,791 "
b	-	-	-	-	161,279 "
c	-	-	-	-	63,563 "
d	-	-	-	-	15,696 "
e	-	-	-	-	2,423 "
f	-	-	-	-	233 "
g	-	-	-	-	14 "
x	-	-	-	-	1 individual

This table is brought nearer to view if we embody the results in a curve such as is given in Fig. 1.

The heavy line is the curve according to Galton's figures, the horizontal transverse lines indicating the sixteen classes of ability. It will be seen at a glance that the average classes A and a contain alone more than one half, and in connection with the classes B and b even five sixths, of the million men; and that the highest grades of ability are drawn out to a fine point. In reality, however, the curve forms here no point, but approaches the vertical line asymptotically, but so closely that already with the class F the two arms of the curve appear to merge with the middle line and with each other. The same holds true of the lower arms of the curve.

Like a lonely mountain peak, or rather, like the spire of a cathedral, rise the men of high talent and of genius above the broad mass of mediocrity. If now we understand that the number of the highly gifted is at all events so small, we may recur to a point previously raised, and see more easily that it is impossible that "many" such can

have been kept back in the lower classes through the incompleteness of social institutions. We recollect, also, that the groups of mediocrity are characterized by association of dissimilar elements, both in general and in particular; in general, because in the same class very different combinations are placed together as of like value; in particular, because

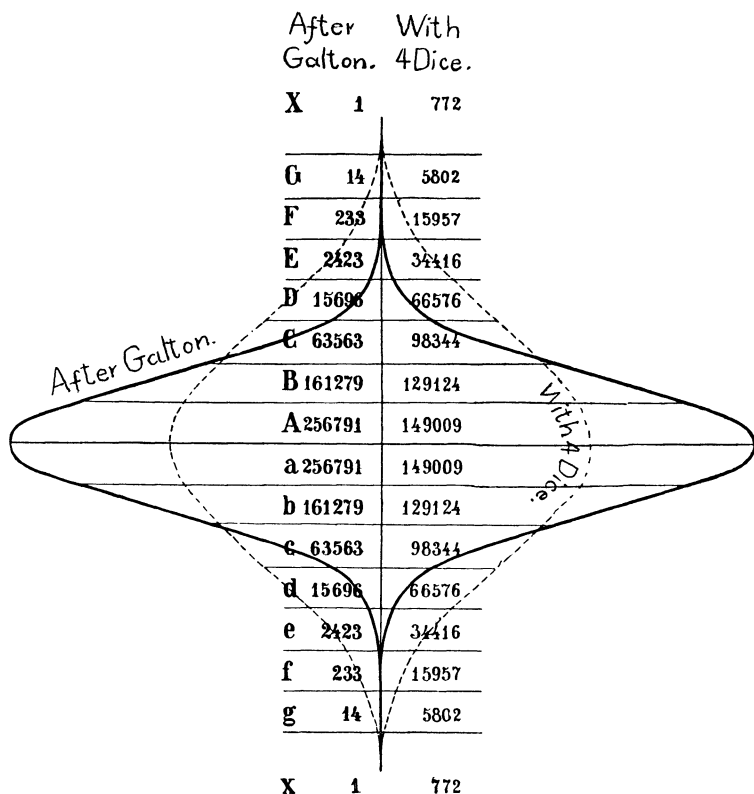


FIG. 1. Graphic representation of the frequency of different grades of Human Ability.

with some brilliant qualities in the individual are associated others which make them ineffective.

The curve runs out to a point below just as it does above, as the number of the poorly gifted, the incapable, and the wholly imbecile decreases in a symmetrical manner.

By means of a dotted line, I have indicated in Fig. 1 a curve

corresponding to our former example of the four dice, after I had adapted the calculation to Galton's sixteen classes. It will be seen that in this curve the same law finds expression, but in a weaker manner. The mediocre groups are not so exclusively predominant, the more exceptional individuals are more numerous, whence the attenuation of the curve is less extreme, although similar in principle. In the classes Aa and Bb there are 279,874 individuals less than according to Galton's calculation, and accordingly 139,937 more in the higher classes and an equal excess in the lower classes.¹ This more slender form of the curve corresponds with the combination of only a few elements or traits; the more elements co-operate the more traits must meet in a genius, the broader is the curve in the center, and the more tapering is its attenuation both above and below.

The individuals of Galton's class c and below are so poorly endowed that they can only with difficulty and in an incomplete way take part in the life of society. In this category belong not only those who are not able to accomplish work which requires intelligence and skill, but also those of insufficient moral character, those who, as the Scotch say, "have taken a skunner" to work, the tramps, vagrants, etc., who could perhaps work if they only so willed, but who have not the stamina to will. Here begins the proletariat, in which body two classes are to be distinguished, namely, the partly useful, and the wholly useless or even dangerous.

In the last named class fall those individuals who are in the lowest stages of intellectual, moral, economic, and physical equipment, such as idiots, feeble-minded, criminals, drunkards, paupers, invalids, etc., who are kept, or rather nursed, in appropriate institutions. Their number reckoned by the million inhabitants would extend from class x upward through class e and somewhat beyond that class. The number embraced in these classes, 2671, if somewhat too small, would be too much increased by the addition of the 15,696 of class d. We must

¹ The correspondence between the number of the upper and the lower grades is worthy of further discussion. I have more recently undertaken inquiries as to whether the symmetry of the upper and the lower arms of the curve is, as Galton assumed without further argument, a necessary consequence of the law under all conditions. The result was that exceptions occur. The traits connected with propagation and nurture yield asymmetric curves, all remaining traits do so, however, only so long as they are in a state of progressive or retrogressive evolution. In the stable stage, all traits (with the exception of those connected with propagation and nurture) are necessarily expressed through symmetrical curves.

assume then that the limit of social utilization cuts through class d, so that part of this class is above and part below the limit. Taking this into account we obtain in Fig. 2 the true form of what is incorrectly called the "social pyramid."

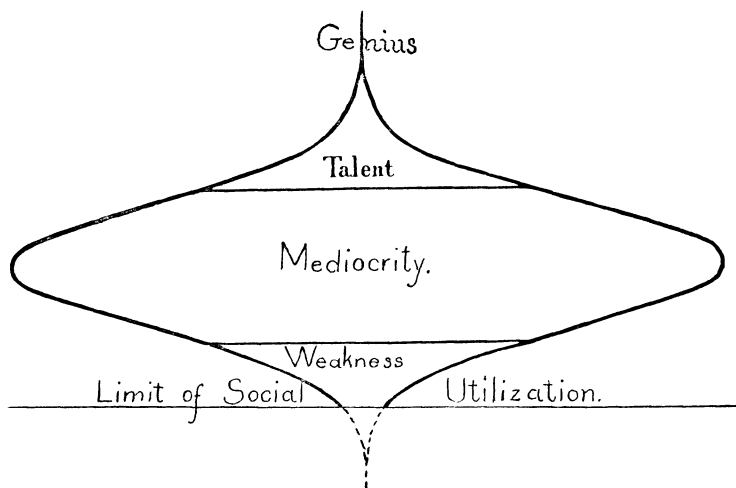


FIG. 2. True form of the so-called Social Pyramid.

The form of this curve is not that of a pyramid, but is rather that, to use a humble comparison, of a somewhat flat onion or turnip. Classes A a and B b contain the great mass of mediocrity, class c and the upper part of d represent a group of slight, if any, social utility, the casual and irregular workers and the occasional as distinguished from the regular inmates of penitentiaries, workhouses, labor colonies, and hospitals.¹

¹[In the judgment of some excellent observers this whole group of casual laborers is not only of no social utility, but is of distinct disadvantage to society. According to Charles Booth the slight amount of work done by this class could be better done by the next highest classes (say by our classes b and a) with advantage to them and society as a whole. Booth even proposes that the casual labor class be taken under governmental control and thus eliminated from the field of free industry. *Labor and Life of the People*, vol. i., London, 1889. Now this casual labor class of Booth corresponds, as I shall show in the next section, very closely to Galton's class c. We ought, then, from this point of view, to draw the lower limit of positive social usefulness along the line between class b and class c. The line as drawn in Ammon's figure might then be called "the limit of social tolerance," that is, the limit below which society finds it inadvisable to tolerate the free activity of the individuals concerned. Making the above changes we obtain the results indicated in Fig. 2a.

In the above figure I have added a dotted line to indicate in a general way the

The intelligent, skilled, and steady workmen belong for the most part to the great classes of mediocrity. According to their trade, position, and skill, they fall in individual cases either above or below the average of ability. It is to be noted that our classes of mediocrity, or of average ability, are by no means the same as what are usually called the "middle classes." The "middle classes" in the conventional sense,

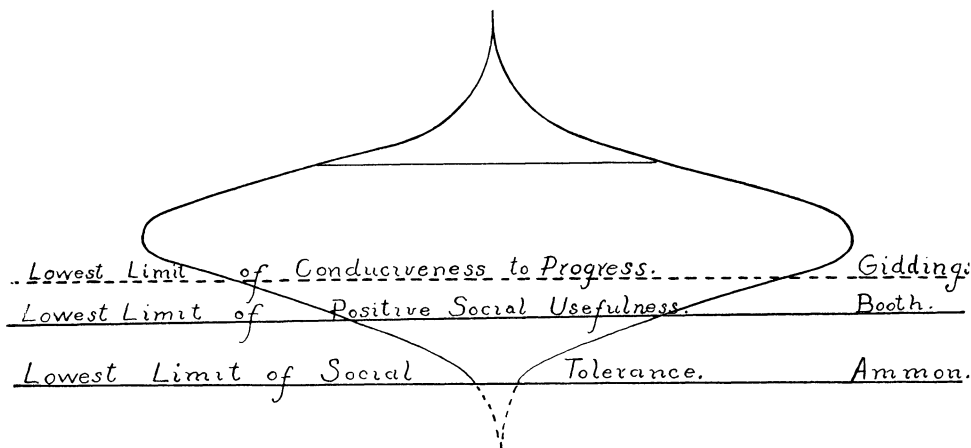


FIG. 2a. The lowest limit of Social Availability.

contain rather the talented personalities of class C and above, and hence it is that they can form only a minority numerically, while if minds could be appraised instead of being counted, they would be found to represent a high proportion of the intellectual and moral energy of society. The persons of classes F and G are found mostly in very high

location in the ability curve of what may be called the lowest limit of conduciveness to social progress. Professor F. H. Giddings has argued in his brilliant paper on the "Ethics of Social Progress" (*Philanthropy and Social Progress*, Boston, 1893, pp. 226 ff.) that the large class of "laborers that have no adaptiveness, that bring no new ideas to their work, that have no suspicion of the next best thing to turn to in an emergency"—although they are, under stable conditions, self-supporting, are a drag on social advance. If they were absent from the community their work could be better done by machinery in the hands of their abler fellows. It may be assumed that the class he has in mind rank about as high as Booth's category of intermittent laborers, or as Galton's class b. Upon this assumption I have located in the figure the lowest limit of conduciveness to progress. The views of Booth and Giddings illustrated in Fig. 2a are somewhat similar to those expressed by Ammon on pp. 192 et seq. of his *Gesellschaftsordnung*.—TRANSLATOR'S NOTE.]

positions of government, industry, law, medicine, science, art, and literature, and the very limited class X corresponds with the occasional man of true genius.

IV.

THE CORRESPONDENCE BETWEEN THE DISTRIBUTION OF ABILITY AND THE DISTRIBUTION OF COMFORT.¹

It is interesting to determine how close is the correspondence between the curve of ability as above plotted, and the empirical curve representing the actual social and economic condition of the population of a representative community.

The most thorough and exact investigation ever made of the condition of a large population, is the study of the population of London conducted by, and under the direction of Charles Booth. He arrives at the following classification of the population of the whole city, outside of institutions :²

Lowest or semi-criminal class	-	-	-	37,610	or	.9	per cent.
Casual laborers or very poor	-	-	-	316,838	"	7.5	"
Poor	-	-	-	938,293	"	22.3	"
Working class, comfortable	-	-	-	2,166,503	"	51.5	"
Middle class and above	-	-	-	749,930	"	17.8	"
				<hr/>			
				4,209,170			

In addition to the above there are 99,830 inmates of institutions. It is perhaps fair to assume that about half of these should be grouped with the semi-criminal or lowest class of the general population. In that case, that class would embrace about 2 per cent. of the total population.

If now we place these percentages in comparison with the percentage of different grades of ability according to Galton, we get at the first glance the following parallelism :

Booth — Condition Classes.				Galton — Ability Classes.	
Semi-criminal class, etc.	2.0	per cent.	1.8	per cent.	Classes x, g, f, e, and d
Casual laborers	-	7.5	"	6.4	" Class c
Poor	-	22.3	"	16.0	" Class b
Comfortable	-	51.5	"	52.4	" Classes a and A
Middle class and above	17.8	"	16.0	"	Class B
				6.4	" Class C
				1.8	" Classes D, E, F, G, X

¹ This section is added by the translator.

² C. BOOTH, *Life and Labour of the People*, London, 1892, vol. ii. p. 21.

I now make certain probable assumptions that will find further justification in the next paragraph. It is probable that Booth's category, the "poor" includes in its upper layers some elements that belong under our class a rather than under our class b. It is clear that the more prosperous of those whom he classifies as comfortable correspond with our class B rather than with class A. Lastly, it is still more evident that many of his "middle class and above" belong with our class C, and above, rather than with B. To make his categories correspond with ours, a considerable number, say from 250,000 to 300,000, or about 7 per cent. of the total population may be transferred from the upper layers of the "poor" to the lower layers of the "comfortable;" about an equal number from the upper strata of the comfortable may be assigned to the higher mediocrity corresponding to our group B; lastly, at least that number of those whom he reckons among the "middle class and above" will rank with our class C. If these changes are made we get the following close correspondence between condition and probable ability:

Condition Classes				Ability Classes			
Semi-criminal class etc.	-	2.0 per cent.		1.8 per cent.		Classes d and below	
Casual laborers	-	- 7.5	"	6.4	"	Class c	
Poor	-	say 15.3	"	16.0	"	Class b	
Comfortable	-	- 51.5	"	52.0	"	Class a and A	
Well to do	-	say 17.8	"	16.0	"	Class B	
Middle class	} say	say 5.0	"	6.4	"	Class C	
and above	} 7	say 2.0	"	1.8	"	Class D and above	

A closer comparison is possible. For most parts of London Booth publishes a classification according to a somewhat more detailed scheme of categories. Adding his figures for east, central, south, and outlying London, and reducing the percentages we get the following results: ¹

Semi-criminal class ²	-	-	-	-	-	2.0 per cent.	approximately
Casual laborers	-	-	-	-	-	10.9	" "
Intermittent Earnings	-	-	-	-	-	10.1	" "
Small Regular Earnings	-	-	-	-	-	13.7	" "
Standard Regular Earnings	-	-	-	-	-	41.7	" "
Superintendents, etc.	-	-	-	-	-	14.8	" "
Lower middle class	-	-	-	-	-	5.5	" "
Upper middle class	-	-	-	-	-	1.9	" "

¹ *Life and Labour of the People*, vol. i. pp. 36 and 242-249.

² Allowing for part of the inmates of institutions as in the former table.

Bringing this table into relation with our ability classes, we obtain the following striking parallelism :

Semi-criminal class	2.0 per cent.	1.8 per cent.	Classes d and below
Casual laborers -	10.9 "	6.4 "	Class c
Intermittent Earnings	10.1 "	16.0 "	Class b ¹
Small Regular	13.7 }		
Standard "	41.7 }	52.4 "	Classes a and A ¹
Superintendents, etc.	14.8 "	16.0 "	Class B ¹
Lower middle class	5.5 "	6.4 "	Class C
Upper middle class	1.9 "	1.8 "	Classes D and above

The correspondence is here most extraordinary. The only serious departure of Booth's results from the Galtonian curve is as regards the percentage classed respectively in the two groups, "small regular earnings" and "standard regular earnings." It is clearly an arbitrary or optional matter just where the line shall be drawn between "small" and "standard." Mr. Booth drew the line at 21 shillings per week. If he had drawn it a little higher, perhaps at 23 or 25 shillings, the two groups would have been as symmetrical as are classes a and A in our table. The other deviation from the curve may be explained in the same way. Under the head of "casual laborers" are a considerable number who would be classed under "intermittent," if the line between these groups were drawn at two days' labor per week instead of at three days. But in any case, the correspondence is already so striking that there is hardly need of these refinements.

Are these parallelisms merely the result of a whimsical coincidence? To me it seems rather that they at least suggest two probable conclusions, (1) that Galton's calculation of the distribution of different grades of ability is essentially correct for such a representative community as that of London, and (2) that there is a fairly close correspondence between the distribution of ability and the distribution of comfort.

The different grades into which Galton divided ability are supposed to be separated by equal intervals. On the other hand, Booth's categories are rather matters of judgment, and the intervals between them are not necessarily uniform. It appears, however, from the results, that in the longer (which was, by the way, the original) list of categories, Booth must have made, perhaps unconsciously, a division which (with

¹ Mediocrity.

the exceptions we have indicated in a preceding paragraph) gives an approximately constant interval between the various grades. At all events, we have now to turn to a somewhat similar scale of human well-being which has for our purpose the advantage of a relation between the categories as exact and definite quantitatively as is the case with the ability scale with which it is to be compared.

V.

INCOME STATISTICS IN RELATION TO THE DISTRIBUTION OF ABILITY.

The income statistics most available for our present study are those of the kingdom of Saxony, the most highly developed of the German states from an industrial point of view. The official statistics for 1890 show that an income of

500 marks was received by 546,138 persons or 38.9 per cent.							
500 to 800	"	"	"	"	401,439	"	" 28.6 "
800 to 1600	"	"	"	"	318,125	"	" 22.7 "
1600 to 3300	"	"	"	"	91,124	"	" 6.5 "
3300 to 9600	"	"	"	"	36,841	"	" 2.6 "
over 9600	"	"	"	"	19,402	"	" 0.7 "
				<hr/>		<hr/>	
				1,413,069		100.0 per cent.	

In order to understand the significance of these figures it is best to embody them in a curve. As preliminary to this we must consider (1) that the intervals of income are unequal and hence must be represented by correspondingly unequal intervals on the vertical line, and (2) that the percentages of persons included in each interval must be modified according to the greatness of the interval.

To consider these points a moment :

1. The intervals are (500—0=) 500 M., (800—500=) 300 M., (1600—800=) 800 M., (3300—1600=) 1700 M., (9600—3300=) 6300 M. Corresponding to these unequal intervals, the abscissæ are marked off upon the vertical axis in Fig. 3.

2. It is clear that, other things being equal, more taxpayers must fall in a large interval than in a small interval of income. We must not take for the ordinates of our curve simply the above percentages, because to do so would give a false indication of a great number of high incomes. We must first calculate how many persons fall within

the *equal* interval corresponding to each hundred marks. This calculation, which is as follows, will give the true ordinates :

up to 500 M.,	38.9 per cent.	$\div 5 =$	7.8
500 to 800 M.,	28.6	$\div 3 =$	9.5
800 to 1600 M.,	22.7	$\div 8 =$	2.8
1600 to 3300 M.,	6.5	$\div 17 =$	0.4
3300 to 9600 M.,	2.6	$\div 63 =$	0.04

The ordinate for the last interval, namely that of all above 9600 M., cannot be calculated, since there is no upper limit to mark the extent of the interval; but this difficulty is of no consequence for our purpose, since even the two preceding ordinates, 0.04 and 0.4, are too small to

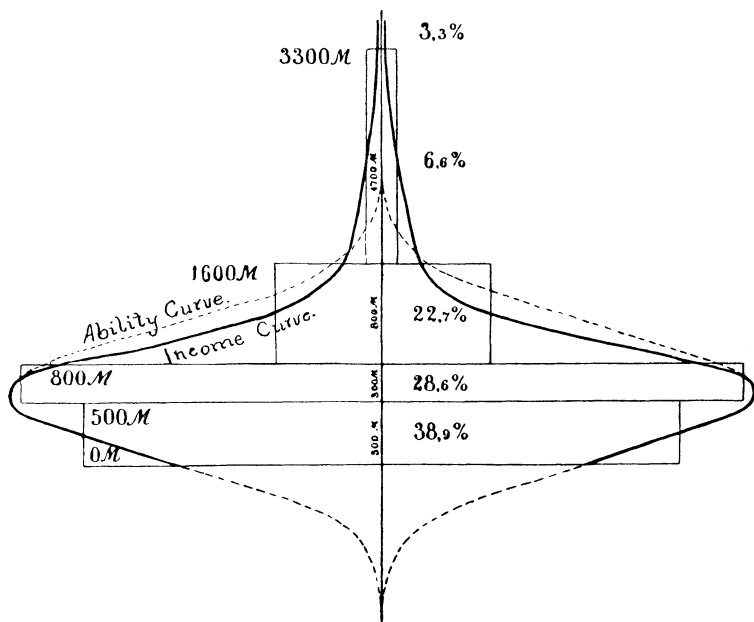


FIG. 3. Graphic representation of the distribution of income in the Kingdom of Saxony (1890).

be graphically represented. In the case of the remaining intervals the ordinates, as above calculated, are marked off horizontally. If now we draw a free curve rounding off the square corners, since in reality the incomes increase gradually and not in broad steps or stages, we get the graphic representation shown in Fig. 3.

The curves of income for Prussia, Baden and other states, as the statistics are summarized in Robert Meyer's article on Income Statistics,¹ would take a similar form, but the comparison is difficult, because the methods of estimating income and the practice as regards division into different classes is so varied. For Prussia, Soetbeer has extended the second lowest class from 525 M. to 2000 M. so that the characteristic bulging of the curve sidewise is obscured.² A curve of incomes for Baden would have to remain incomplete because the number of tax-free citizens with incomes of less than 500 M. has not been recorded. The statistics of Saxony are not only the most complete, but, because of the strongly marked industrial character of the country, the most interesting for our present purpose. To these statistics we will therefore confine our attention.

Two truths will at once appear upon an examination of Fig. 3: (1) that the form of the curve of incomes (except at the base) very nearly coincides with Galton's curve of the distribution of ability; and (2) that the income curve is not symmetrical above and below but corresponds more nearly to what we have called the "true form of the social pyramid" (see Fig. 2), which like the income curve, stands upon a horizontal base line.³ For the clearer demonstration of these correspondences, I have by the dotted line in Fig. 3, shown the contour of Galton's curve.

The first truth contains nothing of the unexpected. The curve of

¹*Handwörterbuch der Staatswissenschaften*, 1890 *et. seq.*, *ann.*

²[That Ammon is correct in assuming that the "bulging" is really present in the distribution of incomes in Prussia is indicated by the statistics given in COHN's *Science of Finance* (VEBLEN'S translation, Chicago, 1895) §§ 319-320. Under the law prevailing up to 1883, the rate of taxation varied according to twelve categories of incomes. The number of persons embraced in the lowest two grades 420-900 M. was 3,742,000 or 75 per cent. of those taxed; the number included in the next two categories was 619,000 or only about 12 per cent. of the total number taxed. I regret that being at present remote from any large library I cannot easily obtain the figures for all twelve categories. But the figures just given are almost enough to prove that the distribution of incomes in Prussia conforms to a similar curve of probability.—TRANSLATOR'S NOTE.]

³[If the reader will turn back to Fig. 2a (footnote, p. 220), it will be seen that the base line of the income curve exactly coincides with the base line (or lowest limit) of positive social usefulness as fixed by Charles Booth. Of course as the data are based on different population groups and different methods of classification, too much weight should not be placed on the exact coincidence. But the general correspondence in the results is at least significant.—TRANSLATOR'S NOTE].

Galton rests upon Gauss's formula of probability which holds for all conditions in which single cases vary from a mean and grow less frequent the greater the extent of the variation. Now these conditions hold good in general with reference to incomes as with reference to abilities, and there is therefore nothing mysterious in the close similarity of the curves.

The slight differences that do appear between the ability curve and the income curve are due partly to the method in accordance with which the income statistics are gathered. The income curve is in the case of the higher classes somewhat fuller, but between 1600 and 800 M. somewhat slighter than the ability curves. In this connection it is to be noted :

(a) The income statistics embrace persons of all ages provided only they are earning an independent income. Now in the upper and middle classes the sons are still students without independent income up to the age of twenty or twenty-five years; while in the lower classes the children frequently begin to earn wages by the time they are sixteen. The children of the former group are therefore excluded while those of the latter are included in the income statistics.

(b) Hence it follows that families with the same income are nevertheless entered under different income groups, according as the family is counted as one unit or as several units. Thus the family of say a subordinate government official with a salary of 1500 M. and with two sons apprenticed, is entered as a unit in the class of 800 to 1600 M.; whereas a family of factory workers in which the father and two sons earn respectively 600, 500, and 400 M., or altogether 1500 M., is entered as three units in the classes below 800 M. Hence in the lower income groups the official figures are larger, and in the middle groups smaller than the real conditions warrant. Statistics, indeed, meets here with insurmountable difficulties, because the conditions of the possessors of income are so dissimilar and so shifting. Thus in the cases just discussed, the expenses of our official's family will be lessened as soon as the sons are through their apprenticeship and obtain an income of their own, whereas in our factory worker's family, a part of the income will be cut off as soon as the sons set up for themselves. But even if the economic position of the two families is for the moment the same, there exists a social distinction, and, from a less temporary point of view, a decided economic difference.

(c) In the highest income categories are reckoned the incomes of

corporations each as one unit. In reality, however, these incomes are divided among the stockholders, that is, among a considerable number of units which belong in the groups below. Hence, again, there is an artificial diminution of the middle income categories, this diminution corresponding this time to an excess in the upper income classes.

It results from the above considerations that the method and form of the official statistics of income tend to contract the curve in the class 800 to 1600 M. unduly, and to expand it unduly in both the lower and the higher categories, and that if the real conditions could be truly expressed, the income curve would correspond even more closely than it now does to the ability curve.

The broadest part of the income curve in Saxony lies, not in the lowest, but in the next to the lowest group, in the group, namely, of 500 to 800 M.; more exactly, the broadest part corresponds to an income of about 600 M.¹ This circumstance shows once more that our groups of mediocre ability correspond with the great mass of the laboring class. The number of persons with incomes below 600 M. is a decreasing one, and the income curve diminishes down to the point of no income, following closely the contour of the ability curve. At this point the income curve ceases. Like the true form of the social pyramid (Fig. 2), it rests upon a horizontal base line.² I have in Fig. 3 continued the lower part of the ability curve by means of a dotted line. This last corresponds with the frequency of what may be called negative incomes, if we may use this term to indicate the net economic

¹ I take this opportunity to dispute the statement made by G. VON MAYR in the *Allgemeine Statistische Archiv*, that in accordance with the real conditions the most frequent income is a lower one, namely, in the class 400 to 500 M. He neglects entirely the circumstance that the rate of taxation increases at the 500 M. point, and that therefore many persons whose income is really somewhat above that point, contrive to be reckoned below it, in order to escape the higher rate. This is psychologically probable, and is shown by the extraordinary excess in the class of incomes returned from 400 to 500 M. Moreover, it is well known, for example in Baden, that because of the difficulty of calculating the peasants' incomes in terms of money, the farmers of a whole village are often reported together at 500 M. each, without regard for individual differences. Similar methods doubtless prevail in Saxony and in other states. Lastly, it is necessary, as we have explained above, to allow for the different intervals covered by the income classes of the official statistics, then to place the groups together as we have done and to round off the rough corners.

² [As already noted, the base line of the income curve corresponds with the base line of Positive Social Usefulness as fixed by Charles Booth. See Fig. 2a, p. 220. —TRANSLATOR'S NOTE.]

benefit to society (certainly a negative quantity) of those who run into debt, of the vagrants, beggars, and thieves, and further, of the inmates of asylums, prisons, poorhouses, and the like, who possessing no income and performing no services, are nevertheless supported. That this negative part of the income curve corresponds pretty closely to the lower part of the ability curve is not only probable on theoretical grounds, but as we have seen in section V, is demonstrated empirically by the statistics in Booth's *Life and Labour of the People*.

With the above similarities we must be content. There will, perhaps, be those whose ultra-schematic sense of justice demands that the most highly endowed or most useful individual shall have the highest income, the next most efficient persons the next highest incomes, and so on. For the purposes of society, it is sufficient if the higher incomes correspond roughly and in large categories with the higher gifts, the lower incomes with the lower abilities. And this, in a large and general way, is what does happen. The variations can be understood and at least partly justified in the light of our theory.¹

Thus, as we have already explained, a strongly altruistic temperament tends to hinder its possessor from rising above a certain stage of income. The same may be said also in general of a high degree of devotion to ideal interests. On the other hand, an egoistic and materialistic temperament favors such a rise. Hence it is comprehensible, if many finely endowed persons of the aristocracy of culture, while they have their own peculiar rewards, fare less well in the goods of this world than men of ruder and perhaps intrinsically lower talents, who devote themselves to business careers. Experience teaches that the highest public officials, statesmen, scholars, investigators, etc., in spite of pre-eminent intellectual powers and exceptional education, do not often rise above a modest income, whereas the upper categories of wealth are filled by the great industrial organizers, merchants, manufacturers, land owners and speculators, bankers, and the like. It can hardly be maintained that the services of this latter class are always more important or useful for society than those of the former. The economic inferiority of the devotees of science, culture, public and altruistic duties, comes not so much from any inferiority of their powers, as from the direction in which they utilize these, and from the

¹ The correspondence holds, of course, only between the numbers of persons in a given income class and in the correlative ability class. The data at hand do not touch the question of a correspondence between ability and remuneration in detail.

temperament of the individuals concerned. In the case of the working classes, however, it cannot be assumed that the small or moderate incomes that prevail are the result of any excess of altruism or of idealism; what is lacking here is, rather, sufficient strength in the intellectual, moral, and economic traits to advance the individual to a higher position.

To what purpose should society attempt to bring about artificially an equalizing of these distinctions? It would be of no general advantage if our officials and scholars could compete with the industrial magnates in luxury and display; on the contrary, it would be a disadvantage, as they would be overwhelmed in the details of the gaining and management of wealth, and their disinterested and ideal aims and activities would suffer. On the other hand, the great prizes of industry and business have their justification as a stimulus to call forth the full efforts of the natural-born organizers who are essential to the industrial welfare of the community. There is, moreover, a tendency toward a certain equalizing of wealth between the two groups concerned, and that, too, in a natural and relatively harmless way, in that the sons of very wealthy men frequently take up official and scientific careers, and that the daughters marry, preferably, persons engaged in these careers. A side income is thus created for officials and scholars which renders them independent without spoiling them—though it must be admitted that it sometimes does this.

Somewhat similar observations hold good in the case of the lower income classes. An improvement in general wages will bring a preponderance of advantages only indirectly through a selective process and only if certain other conditions are fulfilled. These matters are treated in more detail in another part of this book. It is possible in the present connection only to suggest certain points: (1) The first consequence of the richer nutrition which an increase of wages makes possible is to stimulate all the activities and instincts. With many individuals the harmful instincts gain the upper hand, and the influences of natural selection tend to destroy such, or at least to prevent the perpetuation of their race—and this to an extent more marked than before the advance in wages. (2) The net result upon the quality of population and the general social conditions is, after the selective process has done its work, advantageous, provided, (*a*) that the better laborers have married principally within their own class, and not with the proletariat proper; (*b*) that the increase of the laboring class has

not been too rapid; (*c*) that the easier conditions have not made it possible for the proletariat to increase; (*d*) that the current of population from the country to the cities has not been too much stimulated; (*e*) that immigration of lower foreign races or nationalities has not been encouraged.

VI.

FURTHER CONSEQUENCES OF GALTON'S ABILITY CURVE.

Many readers will not easily make friends with the thought that the number of men of genius and high talent should be so small that the highest class should be represented by only one person in a million, and the highest three classes together by only 250 in a million, or only one in four thousand. Whoever follows the matter to its foundations, however, will not deny that theoretically the middle part of the curve ought to be much more extended, and that the proportion of the highly talented should be even smaller, that is, if we take into account only those laws that have been considered up to this point.

The proof is that with eight dice of six sides each, as we have seen, the highest throw, an all six, would occur only once in 1,679,616 possible throws. There are, however, surely more than eight separate traits which must combine in one man of true genius, and it is not an overstatement to regard the given traits as at least six times as strongly developed in the man of genius as in a weak-minded person. We have seen, further, that with eight twelve-sided dice the highest throw is found only once in 430 millions. More than all this, it has been shown that the same law of probability applies further to diminish the frequency with which the higher grades, as compared with the mediocre grades of each particular trait, can occur. If we consider all this, it appears that the man in whom the different traits combine, each in the highest degree of strength, would occur not once among a million, as Galton assumes, but only once among many millions. The empirical evidence, however, shows, as we have seen, that Galton's figures correspond fairly closely to reality. It would then seem that there must be some causes not yet brought into consideration which favor the production of men of genius and talent.

Such we shall find to be the fact. Galton himself gave this point no consideration, since he believed that he had guarded against any such difficulty by his theory of "stable forms." This theory rests on the assumption that certain mutually helpful characteristics have already,

as tendencies in the germ plasm, formed a very closely united group, so that they are not easily separated in the reducing division, and are therefore transmitted together. A support for this theory could be found in the phenomena of "correlative heredity" as described by Darwin, who shows that related parts of the body vary in the same direction; that, for example, the feathered feet of doves take this peculiarity from the wings. But it is also established by Darwin that long beaks and long legs go together. Beaks and legs have nothing directly to do with each other, although the picking up of food on the part of long-legged birds is of course facilitated by the possession of long beaks. These correspondences can also be explained in this way: that the influences which in the germ plasm cause a variation of the determinants of different parts of the body, work in the same or a similar direction, without there being necessarily any closer relation than this among these determinants. Against Galton's theory of stable forms is the fact that selection is able to separate the peculiarities alleged to be connected. Thus it is possible, by methodical selection, to breed birds with short beaks and long legs. Man himself has been treated in a similar way by natural selection, for his legs are disproportionately long and his arms relatively short; and this peculiarity can have been brought about only through natural selection in adaptation to an upright position or carriage. The young of a species often present at first the older or original structure, which disappears only with their growth. Thus new-born children, with their upper and lower limbs of nearly equal length, show the characteristics of quadrupeds. Children even in the second or third year can easily go on all-fours, while grown people, if they attempt to imitate them, will generally fall on their knees. Still more strikingly, the fact that the short toes are associated with the long legs and the long fingers with the short arms, contradicts the assumption of correlative heredity and of stable forms.¹

This applies equally to the mental traits. The peculiarities which are to become mutually useful in the individual, as, for example, intellect and will power, are represented in the germ plasm only by small, hardly distinguishable structural elements, the mechanical connection of which depends probably upon molecular forces wholly different from those which correspond to the given mental traits in the mature individual. Moreover, Galton's assumption could explain only the

¹ Cf. A. WEISMANN, *Die Allmacht der Naturzüchtung*, p. 11, Jena, 1893.

transmission of the existing characteristics of a man of genius to his children, not the frequent new appearance of genius through the happy combination of certain traits of different ancestors. This last mentioned phenomenon gives us the key to the riddle.

There exists in society a natural institution which performs the function of rendering the suitable combination of two individuals in marriage far more frequent than it would be under the mere laws of probability. This institution is the most remarkable which the evolution of social life has produced. It exists exclusively among men, but in human society it is universal; it exists in an incomplete way even in the lowest known stages of culture, and it develops into a more effective form in the higher stages. This institution is the separation of the superior classes from the great mass of the population.¹

VII.

THE SIGNIFICANCE FOR THE LIFE OF SOCIETY OF THE EXISTENCE OF SOCIAL CLASSES.

By most educated persons, as also by most publicists and sociological writers,² the existence of more or less exclusive social classes is regarded as an unfortunate relic of half barbaric times, as a harmful survival which one would do away with if it were possible. Fortunately it is impossible. The social instinct of individuals is infinitely more powerful than are rationalistic abstractions of the equality of all men. As in even the lowest stages of culture there is something of a barrier

¹ "It will always be true that superior power and faculty will secure superior advantages, and that these advantages will have their effects in personal character and situation." "They seem to increase with civilization, because progress implies variation.

"It is the common boast in America that we have no social classes . . . but the fact of stratification exists. . . . Social stratification in America rests . . . chiefly on wealth [culture] and occupation. Those who are relatively rich and can command fine houses, indulge in luxuries and cultivate fine manners, *separate themselves from the others*. . . . The manifestations of the classification are in the choice of the best residence districts in the cities [in various kinds of display] . . . and in marriage alliances."—C. R. HENDERSON, *Social Elements: Institutions, Character and Progress* (New York), 1898, pp. 279–280.

² [It is interesting to consider Ammon's treatment of social distinctions and privileges in comparison especially with the treatment of the same subject in BENJAMIN KIDD's *Social Evolution*, since both authors start out from the theory of natural selection. See also MALLOCK, *Aristocracy and Evolution* (New York, 1898).—TRANSLATOR'S NOTE.]

between the families of prominent chieftains and the rest of the tribe, so in the highest developed societies social classes continue in spite of all theoretical objections, and the members of each class marry preferably within their own order. An institution which is so extended throughout the race, which maintains itself so stubbornly against all the alleged grounds of reason, which if forcibly done away with, shortly reappears, must necessarily have some kind of social utility. This everyone familiar with the point of view of natural science will admit. As a matter of fact the institution in question performs several different functions in the life of society. The most important and distinctive of these functions is that which has been already suggested. It is the only one with which we need to concern ourselves in the present connection.¹

The existence of social classes restricts "panmixia" and thereby makes possible a much more frequent production of highly endowed individuals.

Panmixia is the pairing of individuals without previous selection. In this sense it can of course occur in monogamy as in polygamy; it is not to be confused with promiscuity or with so-called "free love," which would not exclude considerable methodical choice. The increase of useful traits requires the union of those individuals who possess the traits in question—be it by methodical, or be it by natural selection. The mere chance union of nondescript individuals cannot produce a higher variety, but will, on the contrary, work against selection. Without continual selection the species could not maintain themselves at the height of their present development; the cessation of selection—that is the prevalence of panmixia—is sufficient to bring about a deterioration of the race.² We will now see how the existence of social

¹ Other functions of social stratification are :

1. The isolation of the children of the superior classes from the great mass makes possible their more careful bringing up and education.
2. The better nourishment and less sordid manner of life of the individuals belonging to the superior classes influence favorably the activity of the higher intellectual traits and thus promote the progress of society.
3. The pleasant conditions of the life of the upper classes spur the members of the lower classes to exert their best powers in competition in order to obtain a share in the same advantages.

² [Cf. KIDD, *Social Evolution*, chap. ii. ". . . if the continual selection which is always going on amongst the higher forms of life were to be suspended, these forms . . . must actually go backwards. . . . if all the individuals of every generation

classes serves to lessen panmixia, and thereby to institute a favorable process of natural selection in the breeding of men.

For this purpose we may assume first that we have a group of one million male individuals, among whom the different degrees of ability are distributed according to Galton's calculation. There will then be one great man or genius of the class X. Now let us assume that this pre-eminent man is to choose a wife from a group of female individuals constituted in the same way of similar grades of ability, containing then one woman of grade X. Let us assume further that neither law nor custom hinders the man from selecting his wife as he chooses. Now the probability that the man of class X should choose the woman exactly fitted for him, that is the woman of class X, is very small, namely, one chance in one million ($\frac{1}{1000000}$). In this connection it should be remembered that the intellectual and moral characteristics of the male ancestors can be transmitted through females to the male children, and vice versa. Under the above conditions, the possibility of a fitting marriage for the most highly gifted individual of either sex and the possibility of a posterity also of grade X would be extremely slight.

If the choice of spouses were left wholly to chance, men of every degree of ability would marry indifferently women of the various grades of ability. High talent would wed mediocrity and vice versa, and we should have what, following Weismann, we have called panmixia. Moreover, with parents of widely contrasted peculiarities it is not to be assumed that the children will resemble the more gifted parent, nor even as a rule that they will equal the average ability of the two progenitors. As we have several times noted in this work, the union of inharmonious parental tendencies is not only disadvantageous in its direct results, but it also carries with it the danger of reversion to earlier stages of development (atavism). Nature commends the union of like and like.¹

Let us now assume that the man of class X, instead of being wholly unguided in his choice is induced through law or custom to choose his in any species were allowed to equally propagate their kind, the average of each generation would continually tend to fall below the average of the generation which preceded it, and a process of slow but steady degeneration would ensue.—TRANSLATOR'S NOTE.]

¹ Cf. AMMON, *Die Gesellschaftsordnung*, p. 12; *Die Natürliche Auslese beim Menschen*, Jena, 1893, § 326; G. V. DE LAPOUGE, *Les Sélections sociales* (Paris, 1896), chaps. i. and iv.

wife only from, say the three higher classes of the female population, that is, from classes X, G, and F. The conditions are now radically altered. Instead of from a million, he has now to choose from only 248 individuals, and the probability that he will choose the one woman of class X is increased from $\frac{1}{1000000}$ to $\frac{1}{248}$, that is, the chances are now over 4000 more favorable that equally pre-eminent geniuses will be born in the next generation than would be the case if panmixia prevailed.

Further, the men of classes G and F have, if their union is confined to the females of classes X, G, and F, the most favorable prospect of producing children whose abilities will not be below class F, while under panmixia the probability that their children will belong to a lower level is very great, namely $\frac{999752}{1000000}$ or about $\frac{3}{4000}$.

In the existence of social classes the members of which preferably marry into families of about equal standing, we have, then, the key to the fact brought forward in section VI, that genius and high talent appear much more frequently than would be the case under the mere law of probability if panmixia prevailed. Although the existence of classes does not altogether prevent panmixia, it greatly limits it; the result of the prevailing class distinctions is to favor the intermarriage of individuals from the highly talented classes and hence to increase the proportion of children of high natural endowment.

It will doubtless be objected that the social classes are not identical with Galton's ability classes, and that marriages frequently occur in defiance of class distinctions. A degree of weight may freely be granted to both these objections. Still they have only the force of exceptions; the general conditions correspond to our assumptions. Moreover, we have ample leeway to allow for the influence of even a great number of exceptions. It is not at all necessary for our argument that the existence of classes should multiply the chances for the birth of gifted persons 4000 times, as we have seen would be the case theoretically, if social distinctions corresponded exactly with Galton's categories of ability. It is enough if the chances are improved a thousandfold or a hundredfold, or even less; and no thoughtful anthropologist will deny that such a favorable influence exists, even if a definite measure cannot be found for its extent. The existence of classes promotes the favorable working of natural selection among men and establishes a natural breeding in the Darwinian sense.

If social distinctions could be abolished and if men ceased to marry

preferably within their class, the consequence would be a marked diminution in succeeding generations in the proportion of individuals of high endowment. There would be correspondingly a decrease in the proportion of those of exceptionally weak capacity,¹ and the result would be even a greater proportion than at present of persons of mediocre or average ability.

OTTO AMMON.

KARLSRUHE IN BADEN.

¹In accordance with the symmetrical form of the ability curve above and below the mean, there would at the same time result a corresponding decrease in the number of individuals of exceptionally poor endowment. For this class also would no longer marry so exclusively among themselves with the effect of producing a similar posterity. We see from this that the institution through which the proportion of the highly endowed is increased has also its unfavorable side. Another disadvantage that it has is the danger that arises from inbreeding. Where a few pre-eminent families constantly intermarry not only the excellencies but also the special defects are perpetuated and intensified, and there result not only exceptionally gifted, but also worthless and even idiotic persons.